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ABSTRACT

Assuming that learning to spell and punctuate involves making and testing hypotheses about how the orthographic style of English works, a study explored six children's classroom spelling during their third and fourth grade years. The subjects were American children of the Tonono O'odham (Papago) tribe of southwestern Arizona who were part of a larger study on writing development in children. Researchers visited the classrooms weekly, observed the children writing stories, videotaped writing episodes, and conducted interviews with the children on their conceptualization of the writing process. The 215 stories were compared for percentages of conventional and nonconventional usage for spelling and punctuation, and for patterns of nonconventional use. Findings showed that (1) high frequency words were almost always spelled conventionally, while words used only once were spelled conventionally about half the time; (2) spelling features that were less frequent, less predictable, or more abstract tended to present more difficulty; (3) spelling generally improved from third to fourth grade; (4) most invented spellings involved reasonably successful efforts to represent phonology; (5) punctuation was appreciably more difficult than spelling for these subjects, with punctuation supplied as needed only 55.6% percent of the time, and conventional spelling provided 86.3% of the time; (6) some punctuation marks were more difficult than others, with periods and question marks provided at least half the time, commas and quotation marks usually omitted; and (7) punctuation improved dramatically from third to fourth grade, despite little instruction other than the practice of writing. Interviews with two of the children showed that most idiosyncratic patterns involved understandable conceptual strategies. A five-page list of references concludes the document. (JG)

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# AN ANALYSIS OF THE DEVELOPMENT OF SPELLING AND PUNCTUATION IN SELECTED THIRD AND FOURTH GRADE CHILDREN

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# AN ANALYSIS OF THE DEVELOPMENT OF SPELLING AND PUNCTUATION IN SELECTED THIRD AND FOURTH GRADE CHILDREN

English orthography (including both spelling and punctuation) is a complex system which carries many types of information: it operates on phonemic, orthographic, graphic, morphemic, syntactic, and semantic levels to help readers create meaning from written text. A writer, of course, must be able to use the orthographic system to create the text in the first place. The mature writer has integrated much of the information that the orthographic system contains and is able to use orthography at a high level of competence and without much conscious attention, but developing writers are still in the process of acquiring this knowledge and learning to use it appropriately.

The purpose of the present study was to explore how children learn and use the variety of linguistic information found in the orthographic system of English, through examining various aspects of the spelling and punctuation found in the classroom writing of six children during their third and fourth grade years. In addition to providing insight into the nature and development of children's orthography, it is hoped that the study will contribute to educational practices which influence how children learn to spell and punctuate.

## The Nature of English Orthography

Any consideration of how children learn to spell and punctuate must first take into account the nature of the orthographic system itself. The orthographic system plays a role in the written version of a language similar to the role of the phonological system for oral

language. Both of them may be roughly described as consisting of a set of rules for translating underlying representations into surface ones for written and oral language respectively. Orthography has a relationship to the phonological system but is not necessarily a direct representation of it; spelling is not merely a transcription of pronunciation nor punctuation one of intonation. As a result, learning orthographic conventions is not a simple matter of establishing one-to-one correspondences between, for instance, phonemes and graphemes. Rather, it involves conceptualizing the workings of a system which expresses meaning in systematic but complex and subtle ways.

In order to explore how this system is learned, it is necessary to take into account all the kinds of information that are contained in the orthographic system and expressed as visual features. In the case of spelling, several parameters are involved.

Phonological information includes the ways in which phonemes are represented by graphemes, such as the phoneme /f/ being represented by the letter F in "fish" and the digraph PH in "phone." (The term "phoneme" will be used to refer to a surface-level "minimal unit of sound capable of distinguishing words of different meanings": Hyman, 1975, p. 59. A grapheme is defined as one or more letters.) In general, the spelling of English vowel phonemes is more complex than that of the consonants; for instance, an examination of even very simple reading materials (those for the first three grades) found 47 different sound/letter associations involving the letter A (E. Horn, 1929). Phonological information alone is not sufficient for producing accurate spelling; this was demonstrated most clearly by Hanna, Hanna, Hodges, & Rudorf (1966); an algorithm they created, which consisted of 203 rules

for translating phonemes into graphemes, was able to produce correct spellings only 49.9% of the time, a performance inferior to that of fourth graders writing comparable words (Simon & Simon, 1973).

Phoneme/grapheme correspondences are also influenced by the orthographic environment (surrounding letters); orthographic patterns are, therefore, the ways in which sequences of graphemes work together to communicate phonemic information. For instance, in the word "hop" the single vowel grapheme is all that is needed to signal a lax vowel phoneme, but in "hopping" the single vowel alone would signal a tense vowel and must be supplemented by a geminate (double) consonant.

Graphemic (or visual) rules occur for relatively arbitrary reasons, such as the E which occurs at the end of "have" because English words are not usually allowed to end in V, or the doubled final F or Z after a lax vowel ("stiff," "buzz"). (See Venezky, 1970, for a detailed discussion of orthographic and graphemic constraints of English spelling.)

One can also describe more general graphemic patterns for written English; although it would be difficult to specify them exhaustively, they are the source of the reader's intuition as to what sequences of letters are common in English (as in the nonsense word "vape"), unlikely ("haap"), or impermissible ("vrlg").

Lexical/semantic features are spelling patterns which communicate an underlying lexical connection even when phonology varies. One obvious case is that of bound morphemes; the past tense morpheme -ED is pronounced three different ways (/d/, /t/, and /əd/), but is almost always spelled ED to indicate that it remains constant as a morpheme. This principle also operates more generally, as in the words "medical" and "medicine," where the c's stand for two different

phonemes, but signal a constancy of meaning. The divergent spelling of homophone pairs is yet another example of how spelling carries semantic information; the spoken form of "their" or "there" is ambiguous but the written form is not. (N. Chomsky & Halle, 1968, have provided the most elaborated view of the lexical/semantic quality of English spelling.)

Punctuation also carries linguistic information; it serves primarily to mark off syntactic units (in the case of sentence-boundary punctuation) but can also provide information about suprasegmental features (intonational cues) or semantic data (such as the emotional tone signalled by an exclamation point or the possession relationship indicated by an apostrophe).

## Learning about Children's Orthographic Knowledge

This study works from the assumption that learning to spell and punctuate involves making and testing hypotheses about how the orthographic system of English works. One can think of a learner's conceptualization of that system as involving, as does other intellectual development, the evolution of increasingly varied and sophisticated mental schemata (Neisser, 1976). In other words, learning to spell and punctuate is seen here not primarily as a process of accumulating knowledge but as one of elaboration and abstraction of increasingly higher-level hypotheses.

Children's written language is a fertile source of data for information about their internalization of the orthographic system. When a child spells a word conventionally, one does not know what processes are involved in producing that representation, whether he or she is applying phonological, orthographic, morphemic, and other generalizations or whether, on the other hand, the word is well enough

known to be produced more or less "automatically" (that is, without any apparent attention to generating it). But the non-standard representations that occur in "invented" spelling (C. Chomsky, 1971) provide, by their anomaly, clues as to what schemata and knowledge base the child is working from. For instance, one can infer that a child may be using a hypothesis such as "Create a progressive verb by adding ING" not when he or she uses it to produce the conventional spelling "going" (which could have been learned as a unit rather than generated by an affixing rule) but when an unconventional spelling like COMEING occurs. As Hodges (1981a) commented, a child's spelling is always a representation of his or her internalized spelling system at that point in time: "An individual's spelling errors are literally graphic expressions of that person's knowledge of linguistic/orthographic reality. There are few random spelling errors in an individual's writing" (p. 220).

Invented spellings are found to some extent in writers of all ages, and change in frequency and quality as writers get older. Children in the third and fourth grades, such as the subjects of the present study, use a variety of orthographic strategies. They control the conventional spelling of many words, particularly high-frequency ones. They use the phonological strategies that have been found in younger children, but also use strategies that reflect knowledge of morphological rules of English (such as -ED endings and consonant doubling) and of meaning relationships between words. These strategies produce both conventional and non-standard or "invented" spellings. Some words are "known" one day but must be re-invented the next (C. Chomsky, 1971). Similarly, children at this age use punctuation marks of all kinds in their writing, with varying degrees of conventionality.

One can also learn about children's orthographic knowledge by looking at data which goes beyond an examination of the spellings themselves, such as evidence about general spelling strategies and about the social setting in which writing takes place. Children's hypotheses about the linguistic information embodied in the orthographic system function within a context of broad strategies (which may or may not be consciously formulated) such as "write down anything if you aren't sure," or "try to spell every word correctly." These strategies are often influenced by classroom norms, vary from individual to individual, and evolve over time. Also, writing usually occurs in a social context where spelling and punctuation are affected not just by the writer's hypotheses but by the availability of resources such as dictionaries and other writers, and where such hypotheses are subject to modification through the influence of personal interaction and, if the context is the classroom, curriculum and instruction. For instance, the progressive verb affixation rule discussed above may be refined if the teacher points out that final E's are dropped before adding -ING. The external world, which includes both written language and personal interaction concerning that language, provides the data through which the writer's schemata evolve toward a more adult perception of orthography. As a result, we can only really understand orthographic development if we replace preconceived, conventional notions about how it occurs with actual observations in the social context (Szwed, 1981).

## Previous Studies of Orthographic Development

Knowledge about spelling appears to begin somewhat globally and eventually to become more specific. The child's first task is to discover some basic principles about orthography, such as directionality, and about the particular system his or her culture uses, as when he or she learns to distinguish letters from other kinds of marks (Clay, 1975; Ferreiro & Teberosky, 1982). Writing at this early stage is often scribbling which is intended to represent a message globally (Heald-Taylor, 1984). Once a child has some knowledge of the alphabet and can conceive of writing as operating on a syllabic or alphabetic principle, invented spelling can be said to have begun, with "phonetic spelling." Read (1975) described how preschoolers produce spellings based on their analysis of phoneme/grapheme correspondences, often representing phonetic properties which are not represented in standard spelling. Slightly older children can be seen to use more conventional phoneme/grapheme relationships in their spelling and to begin incorporating greater knowledge of orthographic and lexical/semantic spelling patterns (Beers & Henderson, 1977; Forester, 1980; Gentry, 1978). The continuing increase in spelling sophistication throughout elementary school is largely due to increasingly varied knowledge of higher-level spelling patterns which go beyond the phonetic (Marino, 1978; Marsh, Friedman, Welch, & Desberg, 1980; Nolen & McCartin, 1984; Schwartz & Doehring, 1977; Templeton, 1979a). There is also a gradual increase in the number of words that can be written "automatically," with little or no conscious attention to their spelling (Smith, 1982).

Much of the research in invented spelling has looked in detail

at various features from different linguistic levels, in order to determine patterns of growth for particular kinds of information. At the level of phoneme/grapheme correspondences, Read (1975) found that even preschoolers represent most consonants accurately, except for ambiguous ones like preconsonantal nasals, flaps, and clusters. Several studies have focused on the spelling of vowels, most significantly those of Read (1975), Beers and Henderson (1977), and Zutell (1979). In general, those vowel spelling patterns which are less predictable (such as the tense vowels, which have several common but unpredictable alternative spellings, as in "neat," "beet," and "Pete") take longer to learn. Patterns which go beyond the simple phoneme/grapheme level and involve the larger orthographic environment, such as consonant gemination, are more difficult still (Marino, 1979; Zutell, 1979). Similarly, bound morphemes such as the past tense -ED marker tend to be spelled phonetically by younger children and more conventionally by older ones (Schwartz & Doehring, 1977; Thomas, 1982; Zutell, 1979). More general lexical spelling (i.e., similar spelling of related but phonologically different words such as "race/racial") appears to be a relatively difficult spelling pattern which is learned even later (Marino, 1979; Templeton, 1979b; Zutell, 1979).

Other research has focused on general reasons why some words are more likely than others to be spelled conventionally. Although the length of a word (Bloomer, 1964) and the regularity of its spelling (Brown, 1970) affect how difficult it is, frequency is the most commonly mentioned variable. Several studies have shown that a small number of words account for a large proportion of running text (Rinsland, 1945; see also Hildreth, 1948) and that such high frequency words are more likely to be spelled conventionally by children (Beers,

1980; Beers, Beers, & Grant, 1981; Goyen & Martin, 1977; Milz, 1983).

Another research current has explored the kinds of strategies that spellers use. Early spellers, as mentioned above, tend to see spelling as the graphic representation of a string of phonemes, often in a very phonetically precise fashion (Read, 1975; Tovey, 1978). Since English spelling represents information other than the phonetic, however, children must eventually abandon this "phonetic hypothesis" (C. Chomsky, 1970). Recent research, particularly many of the studies collected in Frith (1980), has thus begun to focus increasingly on the role of visual factors in spelling. For instance, there is evidence that poor spellers are often those who fail to draw on visual information but overrely on the phonetic (Barron, 1980; Sloboda, 1980), and that internalized visual awareness of the orthographic patterns of English develops gradually over time (Juola, Schadler, Chabot, & McCaughey, 1978). In general, good spellers have been found to use a wide variety of strategies (Radebaugh, 1985) and to draw on a range of linguistic knowledge (Marino, 1980). In mature spellers, such strategies are integrated into a sophisticated (but not necessarily conscious) conceptualization of English orthography (Beers, 1980; Zutell, 1978).

Punctuation is also learned gradually. Young children must first learn to distinguish punctuation marks from letters and numbers (Ferreiro & Teberosky, 1982). In the early grades of school, children omit punctuation a good deal of the time, as well as using it in plausible but unconventional ways, such as a period at the end of every line (Cordeiro, Giacobbe, & Cazden, 1983; Milz, 1983); eventually their usage becomes less idiosyncratic and more conventionalized (Edelsky, 1983).

## Orthography in the Classroom

In earlier years, research on spelling instruction was focused largely on the relative effectiveness of variables such as the number of words studied and various testing techniques, considered within the paradigm of a formal spelling curriculum. (See T. Horn, 1969, for an exhaustive review of such studies.) More recently, classroom research in orthography has taken a broader look at how spelling and punctuation are used in the school context, as well as suggesting potentially growth-enhancing classroom environments (including but not limited to formal instruction: Henderson, 1985; Hodges, 1981b, 1982). Descriptions of invented spelling and punctuation in the classroom have become common. (Calkins, 1980a; C. Chomsky, 1971; Giacobbe, 1981; Hall, 1985; and Kamii & Randazzo, 1985 are representative examples.)

The increasing sophistication of knowledge about invented spelling has also suggested new evaluation techniques. Teachers have been encouraged to analyze children's error patterns in spelling, with emphasis on understanding their underlying hypotheses and on being aware of qualitative differences between spellings (Ganschow, 1981, 1984; Hasselbring & Owens, 1983; Marino, 1981). The importance of looking at contextualized spelling rather than test results has also been recognized (Cramer, 1976). Teachers and researchers have also begun using interviews to probe students' knowledge about orthography (Calkins, 1980b; Ganschow, 1981; Radebaugh, 1985).

## Methodology

The subjects of this study were six children of the Tohono O'odham (Papago) tribe of southwestern Arizona, who were originally subjects of a study by Goodman (1984; see also Goodman & Wilde, 1985)

which explored the writing process in the classroom setting. The subjects were chosen to reflect a range of development as writers. According to interviews with their parents, all of the children spoke English as their first language; most of them understood and spoke limited amounts of the O'odham language but none of them were fluent in it. A phonetic analysis of one of the subjects was conducted to determine whether there were features of the local dialect which were likely to influence spelling. Although there were slight variations from other dialects of English, they were primarily subphonemic, such as vowel length and the insertion of glottal stops. There was therefore no attempt to systematically seek out dialect influence on spelling, although it was considered in the few cases where it may have influenced particular spellings. It should also be remembered that all spellers (e.g., Read's 1975 Boston-area subjects) speak a dialectal variation of English. (See Brengelman, 1970, and Stever, 1980, for general discussions of the spelling/dialect issue.)

During the two years of the Goodman study (the subjects' third and fourth grade years), researchers (including the present author) visited the children's classrooms weekly and observed them as they wrote. During the observation periods, the researchers systematically collected field notes describing the children's behavior as they wrote. In addition, some writing episodes were videotaped, and periodic interviews were conducted where the children were asked to discuss their stories and their conceptualizations of the writing process.

The writing that the subjects produced was primarily that which would have gone on in the classroom ordinarily, rather than being assigned or otherwise shaped by the researchers. The classrooms were unexceptional ones; although the teachers generally allowed time for

writing every day, they did not have any special expertise in the teaching of writing. Also, there was virtually no formal instruction about spelling and punctuation; the teachers did not use spelling or English textbooks or conduct class or group instruction in this area, although they did discuss spelling informally from time to time, with the entire class or in individual conferences.

Each story the children wrote was converted into a form suitable for computer analysis, including listings of all words used and the number of conventional and invented spellings for each one. (Conventional spellings are defined as dictionary spellings of a word, including acceptable variants; all other spellings are considered non-conventional or invented ones, terms which will in most cases be used synonymously.) The data base for the present study included data for six subjects who were involved in the research for two years; it consisted of 215 stories containing 13,793 words, with 1,896 (13.7%) of those being invented spellings. There were also 1,405 punctuation marks, 1,254 of them conventional and 151 extraneous, as well as 1,001 omissions of punctuation.

In general, the data was analyzed by comparing percentages of conventional and non-conventional usage for various spelling and punctuation features and then analyzing patterns of non-conventional use. Also, typical spelling and punctuation patterns for three subjects were compared in order to characterize differences between them, and anecdotal data for two subjects was explored. Further details of data analysis are discussed in conjunction with each aspect of the findings.

It should be noted that a major difference between this research and much of the previous analysis of invented spelling was the use of a natural data base. Although Read (1975) used samples of

preschoolers' natural writing, the equally well-known studies from the University of Virginia (summarized in Henderson, 1985) and other analytical studies have for the most part relied on researcher-administered spelling tests in order to isolate particular orthographic features. The value of using a natural writing data base will be discussed later in this paper.

## Analysis of Invented Spelling

A brief look at a single sample of invented spelling suggests some of the patterns that occurred throughout the children's writing. When Gordon wrote FOR THE HOLE YAER I WAS GOOD in a story about Santa Claus, knowledge about several levels of language contributed to his invented spellings HOLE/whole and YAER/year. (Invented spellings are written in upper case; the lower-case spelling following a slash is the conventional one for the word the child was writing.) At the level of phoneme/grapheme correspondences, it can first be observed that he did not choose the appropriate initial consonant letter for "whole." Using the wrong initial letter was a rare occurrence in these children's writing and can here undoubtedly be explained by the silent W. All other consonants were spelled appropriately in the two words, as was the tense vowel in "whole." The spelling of the more difficult rhotacized (r-controlled) vowel in "year" included the appropriate letters, but with E and A in reverse order. Semantic knowledge tells us that the spelling HOLE is a real word, indeed a homophone of the intended "whole." Looking at other data about Gordon reveals that neither of the words under consideration was used by Gordon during that school year other than this one time, while the other, conventionally spelled, words in the sentence were used more often, each appearing from 5 to 106 times in his writing for the year. In addition, field

notes reveal that YAER was not Gordon's first attempt at "year," nor was his writing of it unassisted; he first wrote YER, changed it to YREN, erased that spelling, found the word in the dictionary, and transposed the two vowel letters as he copied from the dictionary. This detailed examination of two individual spellings can be said to be a vertical view of spelling: considering single pieces of data at multiple levels. The findings of this study represent a horizontal analysis of the data: taking features such as vowel spellings, or parameters such as word frequency, and examining their role across the 1,896 invented spellings of six children over two years. A similar horizontal analysis of punctuation was also done, and the analysis of the orthography itself was supplemented by anecdotal data derived from field notes and interviews.

To analyze is to take apart, but meaning is ultimately found in the new synthesis that results. It is therefore important to remember that looking at single features of children's spelling and punctuation is merely an intellectual tool for making some sense out of the complexity contained therein; the ultimate value of this kind of analysis lies in creating a greater sophistication of perception, so that one can return to observing children's writing with a heightened sense of the complexity embodied in their orthography, or, in other words, with more highly developed vertical perception.

Before discussing the findings in detail, it should be noted that since they are drawn from a small sample they are intended to apply only to these six subjects, not necessarily to all third and fourth graders. However, the findings can be triangulated with those from other studies (Guba & Lincoln, 1981) and can suggest fruitful areas of exploration for future research.

How Well Did the Subjects Spell?

The recent focus on the ingenuity of children's invented spelling should not blind one to the fact that by the middle of elementary school, children spell most words conventionally; for instance, the National Assessment of Educational Progress studies (Mellon, 1975) found that nine-year-olds spelled 92% of all words in a free writing sample correctly. The present subjects also used conventional spellings for most words: 86.3%, or six out of seven words.

How Important Was Word Frequency?

As mentioned earlier, word frequency has long been recognized as an important influence on how well words are spelled. The present subjects are no exception. The effects of frequency were examined by dividing all the words written by the children into three categories. High frequency words were defined as those used most often which cumulatively made up 50% of all words in the subjects' texts. Low frequency words were defined as those which occurred only once in the subjects' writing taken as a whole. (These made up about 5% of running text.) All other words were considered as being of medium frequency. Table 1 shows how they compared.

Table 1
Conventionality of Spelling
High, Low, and Medium Frequency Words

| | Conventional | | Non-Convent. | | Total | # of Diff. |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | words |
| High Frequency | 6,708 | 97.64 | 162 | 2.36 | 6,870 | 37 |
| Low Frequency | 383 | 56.41 | 296 | 43.59 | 679 | 679 |
| Medium Frequency | 4,806 | 76.97 | 1,438 | 23.03 | 6,244 | 902 |
| All Words | 11,897 | 86.25 | 1,896 | 13.75 | 13,793 | 1618 |

High-frequency words (such as "the," "I," and "was") were almost

always spelled conventionally. By contrast, words which were used only once were spelled conventionally only somewhat more than half of the time. The medium-frequency words fell almost exactly halfway between the other two categories as to how conventionally they were spelled. Although to some extent these findings can be attributed to the fact that many of the very high-frequency words are short, simple ones with regular spelling patterns, familiarity can also be presumed to play a part. For instance, the words "quit" and "quite" appeared only once each in the data, both as invented spellings. (In fact, each was spelled as the other, by different children.) "Came," with a similar vowel spelling pattern but appearing 54 times throughout the two years (the 41st most frequent word), was spelled conventionally 95% of the time.

It is clear, therefore, that most of the growth in spelling performance occurring beyond the middle of elementary school will involve the new words that children continue to bring into their writing. (In fact, the persistence of a certain number of invented spellings in children's writing may be a sign that they are continuing to expand their productive written language vocabulary.) Hildreth (1947, 1948), sounding surprisingly contemporary when read today, spoke to this issue when she suggested that children are likely to learn the spellings of the several hundred most frequent English words through incidental learning by the end of third grade, and that spelling instruction should help them to find out the spellings of the other words they wish to use in their writing, which will vary widely from student to student.

To What Extent Did the Subjects Control Selected Features of English Spelling? Why Were Some Features More Difficult than Others?

Several features of English spelling were chosen for this part of the analysis, in an attempt to get a general sense of which linguistic

features present relatively greater and lesser difficulty for children. The features were chosen to represent a variety of levels of spelling knowledge. They were also (based on a preliminary examination of the data) chosen because they appeared to be still undergoing development at this age level and because they occurred frequently enough in the children's writing to provide sufficient instances for analysis.

First of all, phoneme/grapheme correspondences were examined; the features looked at were initial letter spellings (i.e., the first letter of each word), stressed vowels, reduced vowels (all occurrences of /ə/ in unstressed syllables) and consonant digraphs containing H (CH, GH, PH, SH, TH, and WH). The stressed vowels examined were those in the most highly stressed syllable of each word; they were further broken down into four categories which were assigned the names "tense vowels" (the letter names A, E, I, O, and U), "lax vowels" (the "short vowels" found in the words "had," "head," "hid," "hot," and "hut"), "rounded vowels" (those found in the words "hood," "hoop," "house," "hawk," and "hoist"), and "rhotacized (r-controlled) vowels" (those found in "her," "far," "hair," "here," and "for"). Two examples of orthographic patterns were chosen for examination: hard and soft C and G and consonant gemination (doubling); these are cases where producing the correct spelling involves consideration of the orthographic environment as well as knowledge about how particular phonemes are represented by graphemes. The extent to which the subjects had internalized the spelling of bound morphemes and rules for their use was explored by looking at their spelling of the affixes -ING and -ED. Finally, the extent to which the subjects were able to use semantic information to differentiate words which sound the same but have different spellings and meanings was explored through looking at homophone substitutions and words containing apostrophes. The latter, involving the

contrast between sets of words such as "dogs/dog's/dogs'," was considered to be a special case of homophone substitution.

For each of these features, all instances were counted and the proportion of conventional and non-conventional spellings determined. Non-conventional spellings were defined as including only those where the feature under consideration was spelled non-conventionally. For instance, the spelling DREMING/dreaming was counted as non-conventional when considering spellings of tense vowels but as conventional when looking at how -ING affixes were spelled. It should also be noted that a certain, fairly small, number of the children's spellings, such as SRIALD/carnival, did not appear to be attempts to represent the word's phonology sequentially. These were necessarily considered to be non-conventional spellings of, for instance, the vowel phoneme involved, but clearly for reasons other than a failed attempt to represent that particular phoneme.

The features were compared by considering whether the subject succeeded or failed in representing the feature appropriately (as with the -ED affix for STARTD/started); all places where a particular feature should have appeared (expected use) were counted and divided into conventional use and failure to produce the feature. However, it should also be noted that features may be overgeneralized (represented in words where they do not appear), as in the use of an -ED ending in SIED/said. This was tabulated where applicable; the only feature which was frequently overgeneralized was the apostrophe. Describing control of particular language features in terms of relationships between opportunity for use, actual use, and overgeneralization where relevant has occurred in previous research on oral and written language (Cazden, 1968; Cordeiro, et al., 1983).

The findings appear in Table 2. The features examined varied

Table 2
Conventional Spelling of Various Features

| Feature | Convent. Use | | Non-Convent. Use | | Total |
|---|---|---|---|---|---|
| | Number | % | Number | % | Number |
| Initial letters | 13,657 | 99.0% | 136 | 1.0% | 13,793 |
| Hard and Soft C and G | 1,324 | 95.7% | 60 | 4.3% | 1,384 |
| Digraphs Containing H | 2,271 | 94.5% | 132 | 5.5% | 2,403 |
| Lax Vowels | 6,925 | 94.4% | 411 | 5.6% | 7,336 |
| Tense Vowels | 3,282 | 93.1% | 244 | 6.9% | 3,526 |
| All Vowels | 12,634 | 92.7% | 997 | 7.3% | 13,631 |
| Homophone Words | 1,387 | 89.1% | 169 | 10.9% | 1,556 |
| Rounded Vowels | 1,495 | 88.9% | 187 | 11.1% | 1,682 |
| Rhotacized Vowels | 932 | 85.7% | 155 | 14.2% | 1,087 |
| -ING Suffix | 230 | 80.4% | 56 | 19.6% | 286 |
| Consonant Gemination | 564 | 79.9% | 142 | 20.1% | 706 |
| Reduced Vowels | 1,179 | 79.8% | 299 | 20.2% | 1,478 |
| -ED Suffix | 254 | 62.0% | 156 | 38.0% | 410 |
| Within-Word Apostrophes | 50 | 40.3% | 74 | 59.7% | 124 |

considerably in how difficult they were to spell, ranging from initial letters, which were chosen appropriately 99.0% of the time, down to within-word apostrophes, which were used when necessary only 40.3% of the time. In general, features which were less frequent, less predictable, or more abstract tended to be more difficult. The effect of frequency can be seen in the case of the stressed vowels (lax, tense, rounded, and rhotacized), where the percentage of conventional spelling was lower for the vowel types that occurred less often in the children's writing. Predictability has to do with how regularly a feature is spelled in English. For instance, the vowels categorized here as lax ones are spelled with a single letter the vast majority of the time, as in "cat," but the spelling of the rhotacized vowels is relatively arbitrary. (E.g., the various spellings of the vowel found in "her," "fir," and "burn" cannot be predicted by the phonetic or orthographic environment.) Abstraction has to do with how closely a spelling follows the alphabetic principle. A spelling pattern which is relatively concrete tends to involve simple phoneme/grapheme correspondences, such as the representation of the initial phoneme in "ship," by the letters SH; a more abstract pattern is one which also represents other information, such as orthographic constraints in the case of geminate consonants or meaning disambiguation in the case of homophones (Henderson, 1981; Read, 1977).

Many comparisons of the data in Table 2 can be made and explained by reference to these three variables (although there was no attempt to quantify their relative importance). For instance, homophones and words containing apostrophes are similarly abstract, but the non-apostrophe homophones are far more frequent (indeed, many of the words involved were common ones like "there" and "to"), which is presumably a major cause of their relative ease of spelling for the subjects. The reduced vowels were more frequent than the

rhotacized ones, but were presumably spelled less conventionally because they are extremely unpredictable, particularly if one is relying primarily on phonetic information. (Spelling a reduced vowel phoneme involves deciding which of many graphemic options should be used to represent the schwa phoneme, a choice which can only be successfully resolved by morphemic or visual knowledge of the particular word involved.) Although the -ED suffix was slightly more frequent than -ING, the spelling of the former is more abstract (and more difficult) because it represents three possible pronunciations while -ING represents a constant one. (Once one has abstracted out the knowledge that -ED represents a morpheme rather than a single pronunciation, the spellings -ED and -ING are equally predictable.)

How Did Spelling Change from Third to Fourth Grade?

In order to determine whether growth took place between third and fourth grade, percentages of conventional use for each year were tabulated for the words as a whole, the three frequency categories, and the particular features that were examined. The significance of the change in each case was determined using a test of differences between proportions (Downie & Heath, 1974, pp. 181-184), with "not significant" defined as cases where the probability of the change's being due to chance was greater than .05.

The results are shown in Table 3, where the categories are arranged in order of proportionate improvement (i.e., a change from 40% to 50% conventional would be described as a 50% improvement). The reader is cautioned to remember in interpreting the findings that third and fourth grade spelling were compared by averaging data produced by six very different children and collected throughout two eight-month school years. Each individual subject's spelling as a whole was also compared for third and fourth grade; only one of them did not show statistically significant improvement, and in her case, it appeared due to a strategy shift rather than

Table 3

Improvement of Various Features
From Third to Fourth Grade

| Feature | Conventional Use - Third Grade | Conventional Use - Fourth Grade | Propor. Change. | Signif. (Prob. of Error) |
|---|---|---|---|---|
| -ED Suffix | 50.8% | 71.7% | 41.1% | <.001 |
| Reduced Vowels | 74.0% | 83.3% | 12.6% | <.001 |
| Rounded Vowels | 83.5% | 92.5% | 10.8% | <.001 |
| Consonant Gemination | 75.3% | 83.3% | 10.6% | <.01 |
| Low Frequency Words | 54.9% | 60.1% | 9.5% | N.S. |
| Within-Word Apostrophes | 38.3% | 41.6% | 8.6% | N.S. |
| Medium Frequency Words | 74.9% | 79.7% | 6.4% | <.001 |
| Tense Vowels | 90.0% | 94.8% | 4.3% | <.001 |
| All Vowels | 90.7% | 94.2% | 3.9% | <.001 |
| ALL WORDS | 84.6% | 87.6% | 3.5% | <.001 |
| Hard and Soft C and G | 94.0% | 97.0% | 3.2% | <.05 |
| Rhotacized Vowels | 84.4% | 86.9% | 3.0% | N.S. |
| Homophone Words | 87.9% | 90.1% | 2.5% | N.S. |
| Lax Vowels | 93.2% | 95.4% | 2.4% | <.001 |
| Digraphs Containing H | 93.9% | 95.8% | 2.1% | N.S. |
| High Frequency Words | 97.4% | 97.9% | 0.5% | N.S. |
| Initial Letters | 98.7% | 99.2% | 0.5% | <.01 |
| -ING Suffix | 82.8% | 78.5% | -5.2% | N.S. |

a real loss in proficiency.)

The subjects' spelling in all but one of the categories improved from third to fourth grade, to an extent that was often statistically significant but not usually spectacular in magnitude. For the most part, those features which were least controlled by the children in third grade were those which showed the greatest increase in conventionality, while those which posed little difficulty in third grade had little room for improvement in fourth. (There was a correlation of -.67 between the percentage of conventional spellings of a feature in third grade and its proportional change from third to fourth grade.) There were some exceptions, however. The spelling of rounded vowels improved somewhat more than one would have expected based on third grade performance, while spelling of within-word apostrophes improved somewhat less than would have been expected and conventional use of the -ING suffix (including the proper use of affixation rules) actually decreased. This suggests that the first feature was a particularly important point of growth in these children's spelling during third and fourth grade, while the other two remained especially difficult.

This data on spelling growth implies that even in the absence of spelling instruction, children who have regular opportunities to write continue to improve as spellers. Although the change may not be immediately obvious to teachers of such children, since it is modest in scale, it occurs across the board, affecting all aspects of spelling.

What Patterns Did Invented Spellings Follow?

For all of the features listed in Table 2, all invented spellings were analyzed to determine what processes were likely to have

been involved in producing them. Categories of explanation were established as they emerged from the data. An exhaustive description of the findings, including counts of the various categories, is beyond the scope of this paper and may be found in the original study (Wilde, 1986); the discussion here will focus on some general trends and themes.

First of all, many spellings reflected knowledge and exploration of the various ways that particular phonemes can be spelled. This was particularly obvious with the vowels; many vowel phonemes have a variety of spellings, so that an incorrect choice may be a reasonable one, as in RODED/rode (cf. "hoed" and "toed"). (In some cases, there was possible dialect influence; vowel substitutions such as HALP/help and a few others, which occurred fairly frequently, may reflect the slightly different categorizations of lax vowel phonemes in these children's dialect.) Homophone substitutions, including those involving apostrophes, are also members of this category (e.g., both "wood" and "would" are legitimate spellings of a particular phoneme sequence, even if the writer has chosen the wrong spelling for the intended meaning). In some cases, spellings which would be appropriate in another orthographic environment were chosen, as in OWT/out; the OW spelling of this vowel phoneme usually occurs word-finally, as in "how." Alternative spelling of phonemes also occurred for consonants, as in SKREMING/screaming.

The subjects can in many such cases be described as spelling phonetically rather than functioning on a more abstract level or drawing on visual knowledge. An obvious example of failure to use knowledge more abstract than the phonetic was in some spellings of words with affixes (e.g., WACHT/watched). Using phonetic rather than

visual knowledge is also the obvious explanation for silent letter omission (NIFE/knife), which accounted for about one-fourth of all initial letter misspellings. One could say that both of these last two are cases where the child's spelling was more phonetic than the standard spelling. There were also about 100 invented spellings which involved collapsed or extraneous word boundaries (RODEDQUEEN, A SLEEP); these can also be seen as reflecting less than full use of morphemic or visual knowledge, but the spellings are acceptable on the phonemic level. One more related group of invented spellings appeared to be due to lack of knowledge of specific orthographic rules, such as those for consonant gemination (HAMER/hammer) and affixation (COMEING/coming).

In general, one may say that all of these types of spellings involved reasonably successful efforts to represent phonology; they were non-conventional spellings primarily because they either made the wrong choice about how to represent a phoneme or ignored higher-level spelling rules. It should be noted, however, that for most features examined there were spellings (rarely more than 10% of all invented spellings for any feature) which were defined as indeterminate or unusual, where it was not possible to decide which grapheme(s) represented the feature involved, as for the stressed vowel in PRODAT/parrot, or the -ED affix in WEDA/worried.

Moving beyond the phonetic, there were also some general patterns seen across many of the categories of spelling features which showed an attempt to produce words that looked as well as sounded right. First of all, a surprisingly high proportion of all invented spellings (32.2%) were real words. Many of these were another form of the same word (TAKE/took), a homophone or near-homophone (THERE/their, TOLL/told), or visually close to the intended word (SING/swing).

Others, however, such as CAKE/chase and WINE/woke, were harder to explain. They may be the result of using common spelling patterns or attempting to create a visually plausible word; the letter sequences used may be produced below the level of conscious awareness while the writer is focusing on matters other than spelling. They may on occasion be slips of the pen for words that the writer could spell conventionally if desired; adults often experience a similar phenomenon where a word other than the intended one is produced (often while one's conscious attention is elsewhere) through some type of integrated movement sequence. Such sequences, first described by Lashley (1951), play an important role for mature spellers who can spell many words by rote; presumably substitutions of one for another occur from time to time.

Another common pattern was that 8.0% of all invented spellings (6.3% in third grade and 9.5% in fourth) were permutations of the intended word; that is, they contained all the appropriate letters but in the wrong order, as in SHCOOL/school, FARTHE/father, and RANOUD/around. This is a considerable proportion, considering all the possible other types of invented spelling. Their greater preponderance in fourth grade than in third suggests that as children's memory of particular words expands and deepens, they will be less likely to produce unusual, unsophisticated spellings but perhaps more likely to produce these permutations which are, of course, very close to the conventional spelling. A child who produces a spelling like COLTHES/clothes has moved far beyond the phonetic strategy which would produce a spelling like KLOZ (or a more diffuse strategy which would produce an unusual spelling); he or she knows the word well enough to include the silent TH, and to not only include the plural morpheme (for

a word which has no singular form in current English) but to write it in the appropriate -ES form. All that is lacking is complete control of the letter order. Permutations are likely to persist into adulthood when writing less familiar words, writing rapidly, or (particularly) when typing. An interesting corroboration of this data comes from the work of Masters (1927). Of 221 invented spellings of "pneumonia" written by students ranging from eighth grade through the end of college, 18 were permutations, with flipping of the E and U the most common. This is the same 8% permutation rate that occurred in the present subjects.

A related phenomenon observed across all categories (but not tabulated as a whole) was the existence of many spellings which differed from the conventional spelling by only a single letter, which may have been dropped (EVER/every), added (OUTHER/other), or changed (RASCUE/rescue). The use of real words, permutations, and single-letter changes all presumably reflect an increasing attention to the visual aspects of spelling.

The information contained in this data allows one to say with some confidence that, although the English spelling system is complex, children are able to explore, to experiment with, and eventually to largely control that complexity. Third and fourth graders are at a point where many of those features of English which are highly regular (such as consonant spellings, even relatively difficult ones like C and G) are for the most part understood. Other features, such as vowel spellings and consonant gemination, are more complex and the subject of hypothesis testing and rule refinement. The abbreviation, which requires visual and semantic knowledge and does not represent a phoneme at all, was the most difficult feature for these subjects.

Although almost every feature was spelled more conventionally in fourth grade than in third, there were no dramatic changes in the types of invented spellings that were used. Perhaps the most noticeable general change, which affected the spelling of many features, was a decreasing number of unusual and indeterminate spellings and an increase in spellings that seemed to reflect a wide range of orthographic knowledge, even if that knowledge was not always perfect.

When looking at any single spelling, one cannot know for certain which types of linguistic knowledge a child was using while writing it or how consciously that knowledge was applied. However, one can look at how that spelling fits into the context of patterns seen across various knowledge levels and formulate hunches as to what was going on. Two spellings can be used to illustrate this: the first is EAT/ate, produced independently by three different children; the second is WEREY/worry, produced by Gordon.

The word "ate" was a relatively common one in the subjects' writing, appearing 27 times during the two years, but was not one of the very high frequency ones which are presumably spelled by rote much of the time. (Indeed, it was spelled unconventionally about half of the time.) Its consonant phoneme is easy to spell, but its vowel phoneme /e/ is a moderately difficult tense one. The spelling EAT involves the use of a digraph spelling for the vowel rather than the appropriate silent final E spelling. Analogy may be involved; this digraph is used in a few other words to represent /e/ before /t/ (e.g., "great"). Visually, EAT is a permutation which contains all the letters of "ate" (as is AET, a spelling also used by some subjects). Finally, EAT is of course not only a real word but one which is another tense of the intended word.

The spelling WEREY/worry also reflects more than one level of knowledge. Its rhotacized vowel phoneme, /ɚ/, is one of the least regularly spelled of all vowels. The spelling ÛR for this phoneme is a relatively uncommon one and occurs in "worry" in order to avoid the confusing graphic sequence WU (Venezky, 1970). Gordon's ER(E) is a somewhat more common spelling of the phoneme, which is found in words such as "her" and, of course, "were." Gemination of the R in rhotacized vowels appears to be for the purpose of distinguishing subtle vowel differences (which do not exist in all dialects) like those between "jury" and "hurry"; since its purpose is far from obvious, it is not surprising that double R did not occur in Gordon's spelling. Finally, this spelling contains the real word "were"; it is, of course, plausible that it was produced not phoneme by phoneme but by writing this real-word homophone for the first syllable of "worry" and then adding the end marker Y.

Many invented spellings are overdetermined, in that there are various possible causes for the choices that are made. A vowel phoneme may be spelled a certain way through rote, knowledge of vowel spelling rules, visual awareness of acceptable letter combinations, or analogy to other words. (This is, of course, also true when spelling is conventional.) There are also, however, spellings, particularly unusual ones, which are less easily explainable. A spelling such as Elaine's DILFTSCT/breakfast cannot easily be broken down for phoneme/grapheme analysis, violates orthographic constraints (such as those concerning acceptable lengths and patterns for consonant strings), looks unusual, includes many unexpected letters, does not communicate any sense of the morphemes it contains, and does not bear any resemblance to real words. Spellings such as these must be discussed in terms of the more general

spelling strategies to be described later.

## Punctuation Usage

A summary of how the six subjects used punctuation over the two-year period appears in Table 4. The first part of the table (Expected Use) tabulates points in the text where punctuation should have occurred and did (conventional use) and should have occurred but didn't (omissions). ("Should have occurred" is used to refer to a reasonable standard of conventional punctuation.) The second part of the table (Observed Use) compares conventional use with points where punctuation should not have occurred but did (insertions). There were also a small number of cases where one punctuation mark was substituted for another.

A number of conclusions can be drawn from this data. First of all, punctuation was appreciably more difficult than spelling for these subjects. Punctuation was supplied when needed only 55.6% of the time, as compared to 86.3% conventional spelling.

Second, some punctuation marks were easier for the subjects to use appropriately than others. Periods, which constituted the majority of punctuation marks, were supplied when necessary 69.3% of the time; the question mark was supplied when needed only about half of the time, while commas and especially quotation marks were appreciably more difficult and usually omitted. The subjects used punctuation other than the period only rarely. (It should also be noted that there was a great deal of variation between individual children in their use of punctuation, ranging from Elaine, who supplied only 33.5% of obligatory punctuation, to Dana, with 84.6%. The more proficient punctuators were more likely to use marks other than periods.)

A final conclusion that can be drawn from the punctuation data

Table 4
Punctuation Usage

Expected Use

| | Conventional No. | Conventional % | Non-Conventional (Omiss. & Subs.) No. | Non-Conventional (Omiss. & Subs.) % | Total No. |
|---|---|---|---|---|---|
| Periods | 1,087 | 69.28 | 482 | 30.72 | 1,569 |
| Commas | 73 | 24.09 | 230 | 75.91 | 303 |
| Quotes | 47 | 15.88 | 249 | 84.12 | 296 |
| Question Marks | 34 | 53.13 | 30 | 46.88 | 64 |
| Other | 13 | 56.52 | 10 | 43.48 | 23 |
| Total | 1,254 | 55.61 | 1001 | 44.39 | 2,255 |

Observer Use

| | Conventional No. | Conventional % | Non-Conventional (Insert. & Subs.) No. | Non-Conventional (Insert. & Subs.) % | Total No. |
|---|---|---|---|---|---|
| Periods | 1,087 | 89.83 | 123 | 10.17 | 1,210 |
| Commas | 73 | 90.12 | 8 | 9.88 | 81 |
| Quotes | 47 | 73.44 | 17 | 26.56 | 64 |
| Question Marks | 34 | 91.89 | 3 | 8.11 | 37 |
| Other | 13 | 100.00 | 0 | 0.00 | 13 |
| Total | 1,254 | 89.25 | 151 | 10.75 | 1,405 |

(not illustrated in this table) is that there was a dramatic improvement from third to fourth grade. The subjects improved from supplying only 46.4% of obligatory punctuation in third grade to 62.3% in fourth, a proportionate increase of 34% which is significant well beyond the .001 level. This growth occurred in the face of little if any instruction, suggesting that, as Calkins (1980b) described, learning to punctuate is a function of learning to write. Cordeiro et al. (1983) described how difficult it is to teach explicit rules for punctuation, particularly periods; perhaps it can most readily develop through encouraging children to use it in their writing and giving them feedback on an individual basis. These data certainly imply that teachers do not have to be concerned that children will regress if not given formal instruction in punctuation; given regular opportunities to write, the subjects all moved toward greater proficiency.

## Orthography in Context

Examining orthography by looking at only the final product, the actual written text, provides knowledge that, for all its complexity, is still incomplete. Observing children as they write and talking to them about orthography may not provide definitive answers to all remaining questions, but they are ways of confirming speculations suggested by the writing itself and of explaining the mechanisms as well as the content of orthography.

Two subjects, Elaine and Gordon, were chosen for such an exploration; all the field notes describing what they said and did as they wrote were examined, as well as transcriptions of interviews with them and their teachers and parents. The summary provided here of this data is necessarily a very brief one, but the original study (Wilde, 1986) contains extensive anecdotes and descriptions.

Linguistic Knowledge

First of all, both subjects were seen actively drawing on various levels of linguistic knowledge. Gordon was on several occasions observed "sounding out" words in order to spell them; that is, thinking consciously about sounds in a word and what letters might represent them. The children also revealed more abstract kinds of knowledge about spelling, particularly in relation to affixation and other morpheme combination. For instance, Gordon was observed on a few occasions writing a root word, then pausing and adding an affix without making obligatory changes in the root word. He was thus aware of affixes as separate morphemes but had not yet refined rules for their use. Both children also showed signs of using visual awareness of words or rote memory as a source of spelling knowledge. Elaine often seemed to rely on sequences of letter names as ways of "knowing" words; particularly early in third grade, she would often make comments like "I know how to spell 'rodeo': R-O-D-E-O."

Although only some of the sources of linguistic information that children draw on as they spell are visible to an onlooker, this brief listing of examples suggests that children are not "just" sounding out, or using morphemic information, or remembering words; they are doing all of these on different occasions. Although English spelling is complex and contains information on many levels, children are perfectly capable of using knowledge from those various levels.

Spelling Strategies

Learning to spell involves not just drawing on one's linguistic knowledge but exploring various spelling strategies. Gordon and Elaine used a variety of these over the two years of the study. These can be

arranged in a rough hierarchy, as follows:

1. Placeholder spelling strategy: "I just wrote it any way."

This was a strategy, used primarily by Elaine, which involved writing only a very rough approximation of a word rather than attempting to produce an accurate spelling. Many of her unusual spellings were produced using this strategy.

2. Human resource strategy: "How do you spell 'people'?"

Human resources included primarily other students and occasionally the teacher.

3. Textual resource strategy: "I need the dictionary."

Dictionaries were only one of a wide variety of print resources which children used to find spellings.

4. Generation, monitoring, and revision strategy: "'Say is S-A-Y, huh?"

This involved a process in which the subjects first generated a possible spelling, using any of the levels of linguistic knowledge described earlier, and then in many cases monitored what they produced, revising and correcting if they thought it necessary.

5. Ownership strategy: "I know how to spell 'rodeo.'"

The higher-level strategies reflect an increasing reliance on one's own resources as a speller. They do not necessarily produce more conventional spelling - asking one's teacher how to spell every unknown word is the best strategy if perfection is the goal - but they involve greater independence as a speller and provide more opportunities for internalization of the spelling system.

The ultimate spelling strategy is ownership: knowing how to spell a word and knowing that one knows. This could also be referred to as spelling confidence. Since most of the conventionally spelled words

produced by the subjects, particularly high-frequency ones, were produced automatically (i.e., below the level of conscious awareness), it is probably fair to say that beginning at a relatively early age, ownership is the most common spelling strategy. Perhaps the process of becoming an adult speller is one of developing that kind of automatic ownership of more and more words, with the less efficient strategies always available to fall back on. It certainly seems true that most adult spellers write most words conventionally and without conscious attention to the process, but also, when necessary or when they choose to do so, they generate and revise spellings, use dictionaries and other textual resources, ask someone, or, in Elaine's words, "just write it any way."

Punctuation

Observing the children also revealed some insights about their understanding of punctuation, which in some cases appeared to be driven by conscious conceptualizations of how it works. Elaine's use of periods and accompanying capitals can be seen as a shift from attempting to follow explicit but incomplete rules to an ability to rely on more intuitive, implicit knowledge, with accompanyingly greater success. Early in fourth grade, her placement of periods appeared quite bizarre: when asked, she commented that she was following rules such as "periods and capitals go together." As a result, she often used strategies like inserting periods before any capitalized word. Later on, after Elaine's teacher had sat down with her and helped her get a feel for the natural pauses in a text that indicate sentence boundaries, her placement of periods improved dramatically.

Gordon for the most part punctuated sentence boundaries effectively; in his case, the punctuation features that involved new

exploration during this time were less common ones like the use of the hyphen in compounds. On November 16 of fourth grade, Gordon began exploring alternative ways to write compounds. He asked, "Does 'football game' go together?" and decided that they did, and that "foot" and "ball" should have a space between them, but smaller than usual because "they go together." If one considers the normal space between words to be a written language visual morpheme denoting a word boundary, Gordon had just invented a new morpheme, a half-space denoting a compound. On December 2, Gordon wrote CLIP-CAKE with a hyphen. (This is a British spelling of the word.) When asked about it, he said that either a hyphen or a small space can be used when two words go together, depending on the writer's preference. This, of course, supplemented his invented half space with a compound morpheme that actually exists in English.

Metalinguistic Knowledge About Orthography

One further angle from which to look at children's knowledge about spelling and punctuation in a larger context is their metalinguistic statements about it: overt conceptualizations about what the role of orthography is, how it works, and how they value it. For example, Elaine saw spelling as important largely for school-based reasons and to please others: spelling was important "so we could learn the words," or "because they're going to ask you to spell something when you go to high school. . . and you're not going to know what it is and they're going to get mad." Even adults need to be good spellers because otherwise "everybody's going to think that you don't go to school. . . and your mother doesn't care."

Gordon, by contrast, felt spelling was primarily important for adult life; his answers to questions about why spelling is important

referred largely to specific on-the-job situations: if you are "police ladies or men you have to write nice so they can understand"; an artist who makes signs for a store also has to spell well because otherwise the store "might not get hardly any money." He realized that there are more options about spelling in some areas of adult life than others: there are forms where all the blanks have to be filled in accurately, but spelling wouldn't matter in a letter to a friend because "it's your writing." (His knowledge of filling out forms may have come from his father, who sometimes brought home work of that type.)

Summary of Orthography in Context

This anecdotal and illustrative description of orthography in the classroom contributes information that could never be known from looking at writing alone. It is perhaps a truism that process is as important as product and crucial to its understanding; this data helps to illustrate why that is the case. In the case of Elaine and Gordon in particular, three important findings are: 1)the complexity of orthography in practice as well as theoretically; 2)the importance of personality and attitude; and 3)the ways in which good and poor spellers are similar. First of all, it is clear that the complexity of English orthography is reflected in a similar complexity of children's orthographic knowledge as they learn the system. Elaine and Gordon showed that they used knowledge at many levels, often in a curious, hypothesis-testing manner. Second, many of the differences between their approaches to orthography were due to Elaine's being concerned with correctness, somewhat rule-dependent, and insecure about her own abilities (although this became less so over time), while Gordon was more confident and independent. Finally, although there were some differences in the kinds of orthographic knowledge and strategies the

two children used and the amount of success they had, there were many, many similarities. Very idiosyncratic patterns such as Elaine's placeholder spellings are more understandable when seen as the result of a strategy choice rather than an underlying deviancy in how she conceptualized or practiced spelling. Perhaps a more productive approach than dichotomizing "good" and "poor" spellers as so many studies have done would be to look for common underlying patterns of strategies used by all spellers and then see how rarer or less proficient strategies fit into that framework.

## Implications

The findings of this study suggest implications for theories of how orthographic knowledge develops, for methodology of further research, and for curriculum and instruction. First of all, the study relates to three theoretical areas: the nature of orthography, the nature of developmental processes in orthography, and the identification of different types of spellers.

First, the findings clearly support previous research about the complexity of English orthography (e.g., Read, 1983; Venezky, 1970a). The subjects' invented spellings were often due to aspects of this complexity, such as, to cite just a few examples, the variety of ways to spell rounded vowels, the different kinds of words that require geminate consonants, and the existence of homophones. The findings also suggest that punctuation is even more complex than spelling.

Second, there is clearly a good deal of growth in orthography taking place beyond early childhood. The subjects for the most part controlled the basic relationships between phonemes and graphemes in English, but were still a long way from being adult spellers. Some of the more subtle features of English orthography were being explored

very actively, with some difficult features like use of the -ED affix, reduced and rounded vowels, and consonant gemination showing the most growth, presumably through the explicit and/or tacit revising of schemata. In Vygotsky's terms (1978), the subjects were very actively continuing to grow into the intellectual world of adult orthography.

Third, the findings suggest that, although there are certainly differences between spellers, the dichotomies between good and poor spellers constructed in earlier research (such as Baron, Treiman, Wilf, & Kellman, 1980) may represent a real oversimplification and reification. Observational data revealed a great deal about the similarities between spellers and illustrated the extent to which differences can be the result of personality and self-selected strategies rather than differing mental processes. The most striking example of this was Elaine's unusual spellings, which were of a type that earlier research would often label as "bizarre" and see as a possible indicator of dyslexia. (See Moats' criticism of such research, 1983.) Field notes revealed that these spellings were created by choice, and that when Elaine chose to attempt conventional spelling, her results were much like those of other children.

An important methodological implication for further research is the value of naturalistically collected data, even for detailed linguistic analysis. Much of the analytical research that has been conducted on spelling has used spelling test data. Although it is certainly more manageable to work with than writing sample data, it is not nearly as rich. If one wishes to explore issues in orthography that are important for children's writing, one can best do so by looking at the full range of words that children spell in their own writing. For instance, studies that have looked at features like vowel spellings

using test data have usually limited their cases to monosyllables; vowels in multisyllabic words create different problems. Also, test-based studies tend to use words that isolate single features as much as possible, while real-life spelling often involves dealing with several difficult features at once (for instance, the homophony, difficult vowel spelling, and apostrophe in "they're"). The insufficient complexity of test-based data is especially true for punctuation; children produce and need to punctuate syntactic structures that are far more complex than any that a researcher would ever include on a test. Also, the importance of corroborative observational data cannot be overemphasized, particularly when attempting to discuss the strategies children actually use. Although test-based spelling research is certainly valuable, it is important to recognize that it can never be as directly relevant as is more naturalistic research.

Finally, these findings have many implications for instructional practice, including teacher education. First of all, a considerable amount of growth in orthography occurred in the virtual absence of formal instruction. Many earlier studies (e.g., Harste & Burke, 1980; Manolakes, 1975) have questioned the value of traditional spelling instruction based on word lists and tests; the present findings can perhaps reassure teachers that children's orthography will not stagnate without direct instruction. Another implication for instruction is that, depending on the generalizability of these findings, teachers may well discover that invented spelling is not a process confined to early childhood but one that is still operating very actively in the middle years of elementary school, albeit in more sophisticated ways. At this age, children are not inventing spellings

phoneme by phoneme the way younger children do, but are continuing to invent various features within words and are increasingly relying on more automatic processes (i.e., integrated movement sequences) which, since they are not always fully accurate, may result in patterns such as permutations.

There are also implications about the kinds of curricular and instructional activities which are likely to support orthographic growth. The observational data in particular suggest that important features in such growth are intellectual curiosity and willingness to risk, development of schemata about English orthography, and development of a wide range of strategies, including both inner and outer resources. Some possible classroom practices that would contribute to these processes are: encouragement of invented spelling, including explicit discussion of the process itself; provision of a wide range of textual resources, especially a variety of dictionaries; encouragement of classroom interaction related to orthography; help in learning to monitor and revise one's own spelling; encouragement of forming one's own intuitive hypotheses about spelling and punctuation; and, most importantly, a wide variety of reading and writing. Working with individual children at critical moments and small group "mini-lessons" are two appropriate avenues for some of the practices described, although the classroom atmosphere in general is probably the most important factor.

One final instructional implication is for evaluation. There is obvious value in evaluating orthography as it is found in natural writing rather than in spelling tests. If spelling well when one writes is the goal of spelling instruction, then that written language context should be the measure of spelling proficiency. Also, the present

findings make clear the value of observing children as they spell and punctuate and talking to them about their metalinguistic knowledge of orthography. Particularly for children whose orthography is unusual, such as Elaine, the teacher can gain a far deeper understanding of the child's mental processes through observation and questioning than through looking at the written product alone. Teacher education, particularly for language arts specialists, could provide instruction and opportunities for both spelling analysis and the observation and interview process.

## A Final Word

This study has illustrated the extent to which learning to spell and punctuate are complex intellectual processes. However, the breadth and depth of children's orthographic knowledge - their linguistic accomplishments, as it were - should not blind us to the fact that the entire purpose of orthography is to facilitate writing. This is analogous to the role of phonological competence in communicating meaning in oral language. Children's interest in orthography stems not only from the intellectual interest of the system itself but also from their interest in expressing themselves in a way that others will understand. Curriculum and instruction must support this by always dealing with spelling and punctuation as tools to facilitate communication rather than as ends in themselves.

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